

# Rocky Mountain Research Station Science You Can Use *(in 5 minutes)*

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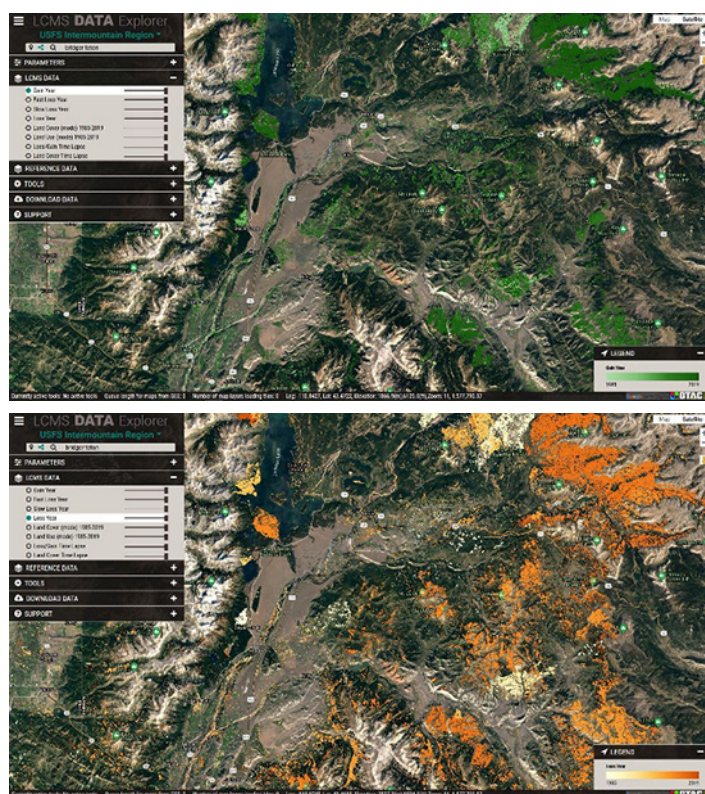
## New Landscape Change Monitoring System Tool Helps Us Understand and Visualize Landscape-Level Changes Over Time

Have you ever wanted to look backwards in time in a particular forest to understand how conditions have changed? There is an important new tool that allows you to do just this through the creation of historical disturbance maps—the [Landscape Change Monitoring System](#) (LCMS). Developed cooperatively by the USDA Forest Service Rocky Mountain Research Station and the Geospatial Technology and Applications Center (GTAC), the tool is the result of data designed using state-of-the-art Landsat time series processing. The LCMS data and tool set allow forest managers to study and visualize forest disturbance history across the Conterminous United States (CONUS) and Coastal Alaska.

“The Landsat Program has been imaging the Earth for almost 50 years. The LCMS team has found new ways to turn Landsat’s archived images into actionable high-resolution maps of past forest cover loss and subsequent recovery,” explained Sean Healey, an RMRS Research Ecologist who leads the LCMS science team in Ogden, Utah.

Reliable data and maps of historical disturbance and recovery are critical for understanding trends in resources such as carbon, water, and habitat. LCMS delivers such data for the CONUS and Coastal Alaska from 1985 to –present to support evidence-based planning and management decisions made by forest managers. LCMS data maps landscape disturbance and recovery using several different methods and applies artificial intelligence to synthesize the outputs into a “best available” record of forest change.

National Forest System regional and forest-level staffs have helped identify many applications for LCMS data, including forest planning and revision,



*LCMS vegetation loss and gain as displayed in the LCMS Data Explorer for the Bridger-Teton National Forest near Jackson, Wyoming. Lighter yellows and oranges represent vegetation loss from the 1980s and 1990s while darker oranges represent vegetation loss from the 2000s and 2010s. Lighter greens represent vegetation gain from the 1980s and 1990s while darker greens represent vegetation gain from the 2000s and 2010s. Graphic provided by: Geospatial Technology and Applications Center (GTAC).*



updating existing vegetation maps, assessing landscape conditions, supporting post-fire recovery, and meeting broad-scale monitoring requirements. “Here on the Bridger-Teton National Forest, LCMS maps have revolutionized our landscape restoration efforts after a wildfire,” said Brian Goldberg, a Forest Service GIS Specialist on the Bridger-Teton National Forest in Jackson, Wyoming. According to Healey, the tool is also being used in the Pacific Northwest to monitor habitat of threatened and endangered species and to update forest carbon assessments across the country.

The Geospatial Technology and Applications Center delivers LCMS training to Forest Service personnel nationally, but a [tutorial for using the tool](#) is publicly available on the LCMS Data Explorer dashboard. The [LCMS Data Explorer tool](#) and data are available to the public, including state governments, business, and private citizens. Non-Forest Service users of the web-based application can view, analyze, summarize, and download LCMS data. They can upload an area of interest and perform pixel- and area-based summaries with a charting feature displaying the results of all LCMS outputs.

## Management Implications

- The [Landscape Change Monitoring System \(LCMS\)](#) is an important new dataset and tool that allows the user to create landscape scale historical disturbance maps.
- LCMS combines satellite imagery with other monitoring data to produce annual maps showing change (vegetation loss and vegetation gain), land cover, and land use, generating a “best available” map covering multiple disturbance processes and diverse cover types.
- The data and tool can assist with forest planning and revision, updating existing vegetation maps, assessing landscape conditions, supporting post-fire recovery, meeting broad-scale monitoring requirements, and other tasks.
- Forest Service personnel can [receive training](#) in using LCMS through the Geospatial Technology and Applications Center (GTAC), but the tool and a tutorial are available to the general public through a web-based application.

## Further Reading

Healey, Sean P.; Cohen, Warren B.; Yang, Zhiqiang; Brewer, C. Kenneth; Brooks, Evan B.; Gorelick, Noel; Hernandez, Alexander J.; Huang, Chengquan; Hughes, M. Joseph; Kennedy, Robert E.; Loveland, Thomas R.; Moisen, Gretchen G.; Schroeder, Todd A.; Stehman, Stephen V.; Vogelmann, James E.; Woodcock, Curtis E.; Yang, Limin; Zhu, Zhe. 2018. Mapping forest change using stacked generalization: an ensemble approach. *Remote Sensing of Environment*. 204: 717–728. <https://www.fs.usda.gov/rmrs/publications/mapping-forest-change-using-stacked-generalization-ensemble-approach>

Cohen, Warren B.; Healey, Sean P.; Yang, Zhiqiang; Zhu, Zhe; Gorelick, Noel. 2020. Diversity of algorithm and spectral band inputs improves Landsat monitoring of forest disturbance. *Remote Sensing*. 12(10): 1673. <https://www.fs.usda.gov/rmrs/publications/diversity-algorithm-and-spectral-band-inputs-improves-landsat-monitoring-forest>.

## For More Information

- The RMRS tool page: <https://www.fs.usda.gov/rmrs/tools/landscape-change-monitoring-system-lcms>.
- The FSGeodata Clearinghouse: <https://data.fs.usda.gov/geodata/rastergateway/LCMS/index.php>.
- The LCMS Data Explorer: <https://apps.fs.usda.gov/lcms-viewer/>. Be sure to select “Science Team CONUS” for national coverage. For specific questions, contact the LCMS helpdesk: [sm.fs.lcms@usda.gov](mailto:sm.fs.lcms@usda.gov).

## LEAD SCIENTIST

**Sean P. Healey** is a Research Ecologist who is interested in assessment of the role of disturbance and management on carbon storage at management-relevant scales, and combining remote sensing, especially Landsat time series, with inventory data to create meaningful spatial data products. Connect with Sean at <https://www.fs.usda.gov/rmrs/people/seanhealey>

Forest Service Research and Development (FS R&D) works with partners to deliver the knowledge and tools that land managers need to sustain the health, diversity, and productivity of our Nation's forests and grasslands for present and future generations. The Rocky Mountain Research Station (RMRS) is one of seven FS R&D units, rooted in the geography of the Interior West, and integrated into a national program with global applications. RMRS science improves lives and landscapes. More information about Forest Service research in the Rocky Mountain Region can be found here: <https://www.fs.usda.gov/rmrs/>



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